

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2003B136	FOR FURTHER ACTION <small>see Form PCT/ISA/220 as well as, where applicable, item 5 below.</small>	
International application No. PCT/EP2004/014475	International filing date (day/month/year) 16/12/2004	(Earliest) Priority Date (day/month/year) 18/12/2003
Applicant EXXONMOBIL CHEMICAL PATENTS INC.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box II).

3. ☐ **Unity of invention is lacking** (see Box III).

4. With regard to the title,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

- a. the figure of the **drawings** to be published with the abstract is Figure No. _____
☐ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☒ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2004/014475

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07C2/18 C07C2/12 C07C2/70 C07C2/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 864 346 A (CHILD EDWARD T ET AL) 4 February 1975 (1975-02-04) figure 1 column 1, line 15 - line 37 column 2, line 64 - column 3, line 13 claim 3 ----- -/--	1,5,8,18



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

30 May 2005

Date of mailing of the international search report

13/06/2005

Name and mailing address of the ISA

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Authorized officer

O'Sullivan, P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2004/014475

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CAVANI F ET AL: "EFFECT OF WATER IN THE PERFORMANCE OF THE SOLID PHOSPHORIC ACID CATALYST FOR ALKYLATION OF BENZENE TO CUMENE AND FOR OLIGOMERIZATION OF PROPENE" APPLIED CATALYSIS A: GENERAL, ELSEVIER SCIENCE, AMSTERDAM, NL, vol. 97, no. 2, 23 April 1993 (1993-04-23), pages 177-196, XP001034799 ISSN: 0926-860X cited in the application page 178, paragraph 5 page 180, line 34 - line 35 -----	1-18,21, 22
X	US 2 681 374 A (BETHEA SAM R) 15 June 1954 (1954-06-15) column 1, line 1 - line 5 column 3, line 3 - line 37 column 5, line 45 - line 54 -----	1
A	US 4 018 846 A (MAYER IVAN) 19 April 1977 (1977-04-19) column 2, line 50 - column 3, line 6 claim 1 -----	1-22
A	US 5 672 800 A (BAES MARLEEN AUGUSTA ET AL) 30 September 1997 (1997-09-30) cited in the application claim 1 -----	1-22

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/014475

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3864346	A	04-02-1975	AU 466991 B2 13-11-1975 AU 4471472 A 24-01-1974 BE 786859 A1 29-01-1973 CA 950558 A1 02-07-1974 DE 2237984 A1 15-02-1973 ES 405461 A1 16-07-1975 FR 2149897 A5 30-03-1973 GB 1381408 A 22-01-1975 IT 990507 B 10-07-1975 JP 48026703 A 09-04-1973 JP 54004637 B 08-03-1979 NL 7210690 A 07-02-1973 SE 378415 B 01-09-1975 US 3733473 A 15-05-1973 ZA 7204826 A 28-11-1973
US 2681374	A	15-06-1954	NONE
US 4018846	A	19-04-1977	CA 1085757 A1 16-09-1980 JP 52083304 A 12-07-1977 US 4073822 A 14-02-1978
US 5672800	A	30-09-1997	AT 155454 T 15-08-1997 CA 2128624 A1 19-08-1993 DE 69312268 D1 21-08-1997 DE 69312268 T2 18-12-1997 WO 9316020 A2 19-08-1993 EP 0625132 A1 23-11-1994 EP 0757976 A2 12-02-1997 JP 2901347 B2 07-06-1999 JP 7503745 T 20-04-1995 ZA 9300594 A 31-08-1993

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220 2003 136 / WO

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/EP2004/014475

International filing date (day/month/year)
16.12.2004

Priority date (day/month/year)
18.12.2003

International Patent Classification (IPC) or both national classification and IPC
C07C2/18, C07C2/12, C07C2/70, C07C2/66



Applicant
EXXONMOBIL CHEMICAL PATENTS INC.

18 Oct 2005 (22 Dec)

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/EP2004/014475

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/EP2004/014475

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2-4,6,7,9-17,19-22
	No: Claims	1,5,8,18
Inventive step (IS)	Yes: Claims	19,20
	No: Claims	1-18,21-22
Industrial applicability (IA)	Yes: Claims	1-22
	No: Claims	

2. Citations and explanations

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

PCT/EP2004/014475

Re Item V**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US-A-3 864 346 (CHILD EDWARD T ET AL) 4 February 1975 (1975-02-04)
- D2: CAVANI F ET AL: "EFFECT OF WATER IN THE PERFORMANCE OF THE SOLID PHOSPHORIC ACID CATALYST FOR ALKYLATION OF BENZENE TO CUMENE AND FOR OLIGOMERIZATION OF PROPENE" APPLIED CATALYSIS A: GENERAL, ELSEVIER SCIENCE, AMSTERDAM, NL, vol. 97, no. 2, 23 April 1993 (1993-04-23), pages 177-196, XP001034799 ISSN: 0926-860X
- D3: US-A-2 681 374 (BETHEA SAM R) 15 June 1954 (1954-06-15)
- D4: US-A-4 018 846 (MAYER IVAN) 19 April 1977 (1977-04-19)
- D5: US-A-5 672 800 (BAES MARLEEN AUGUSTA ET AL) 30 September 1997 (1997-09-30)

1. Issues of clarity affecting the assessment of novelty & inventive step

The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear. The terms "conversion of olefins", "conversion conditions" and "conversion product" used in claim 1 are vague and unclear and leave the reader in doubt as to the meaning of the technical features to which they refer, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT. Additionally, the application does not meet the requirements of Article 5 PCT because all possible "conversions" and "conversion products" of olefins have not been disclosed in a manner such as they may be carried out by the person skilled in the art.

Novelty (Art 33(2) PCT)

The above-mentioned lack of clarity notwithstanding, the following novelty objections apply:

The subject-matter of claims 1,5,8,18 is not new in the sense of Article 33(2) PCT with regard to document D1. D1 discloses (column 1, lines 15-37; column 2, line 65- column 3, line 13) a process for the conversion of an olefin and a paraffin, the water content of the feed being automatically controlled according to an analysis of the composition of the feed.

D2 discusses the effect of water on the performance of solid phosphoric acid in the alkylation of benzene to cumene and for the oligomerisation of propene. It is recognised therein that the water content of the feedstock is an important reaction parameter having an effect on the productivity as well as the purity of the product, ie cumene (see page 178, paragraph 4- page 179, paragraph 1). It is also recognized that the overall life of the catalyst may be improved by an accurate control of the water content (p179, top paragraph). In the tests carried out in D2, the water content of the feed stream was measured with an online moisture analyser from Parametrics (see application, page 13, line 30). However D2 does not explicitly refer to automatically *controlling* the water content of the feed according to an analysis of the composition of the feed. Present claims 1-22 are therefore considered novel over D2.

The subject-matter of claim 1 is not new in the sense of Article 33(2) PCT with regard to document D3. D3 discloses the polymerisation of olefins employing a phosphoric acid catalyst in which the water content of the hydrocarbon feed is analysed using for example a Foxboro Dynalogue (column 3, lines 3-37). The water content in the feed is controlled in response to the output of the water analyser (column 4, lines 43-64).

Inventive Step (Art 33(3) PCT)

D2 is considered as the closest prior art since it discloses both the oligomerisation and alkylation reactions of the present application and discusses the same issue treated in the present application, namely the effect of feed water content on the performance of the catalyst and the yield of the product.

In the tests carried out in D2, the water content of the feed stream was measured with an online moisture analyser from Parametrics (see application, page 13, line 30). The aim of the experimental part of D2 was to plot the role of water (measured by the analyser) on the catalyst performance in terms of activity/selectivity and lifetime. The water content was therefore not kept constant but varied and measured in order to be able to construct plots such as figs 1-3. Suggested operating conditions in D2 are dictated by the type of

application; it is recommended that for feeds with higher than recommended water content, some drying pretreatment of the feedstock may be appropriate (page 193). In the conclusions on page 195 of D2 the authors note that the reported data indicate that rather fixed water contents in the feed are necessary to maintain a defined phosphoric acids distribution, that gives rise to the best catalytic performance.

The difference between D2 and the present application is therefore that D2 does not explicitly suggest using the water analyser of the experimental part of D2 to directly control the water content of the feedstock. The problem underlying the present invention may therefore be formulated as the provision of an improved process for the oligomerisation or alkylation of olefins in which the water content of the feedstock may be controlled in order to achieve the advantages in activity/selectivity and catalyst lifetime mentioned in D2. It is considered that the skilled person wishing to solve said problem would have looked to using the water analyser mentioned on page 180 of D2 in order to control the water content of the feed to within the limits prescribed therein. Present claim 1 can therefore not be considered inventive.

Dependent claims 2-18, 21-22 do not appear to contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step.

Even though Document D5 discloses the importance of water content of the feedstock in the oligomerisation of C_{2-12} alkenes, it is not considered that the skilled person would have combined D5 with D2, which discusses exclusively solid phosphoric acid catalysed reaction in order to arrive at the subject-matter of present claim 19 and 20. Said claims are therefore considered as inventive.